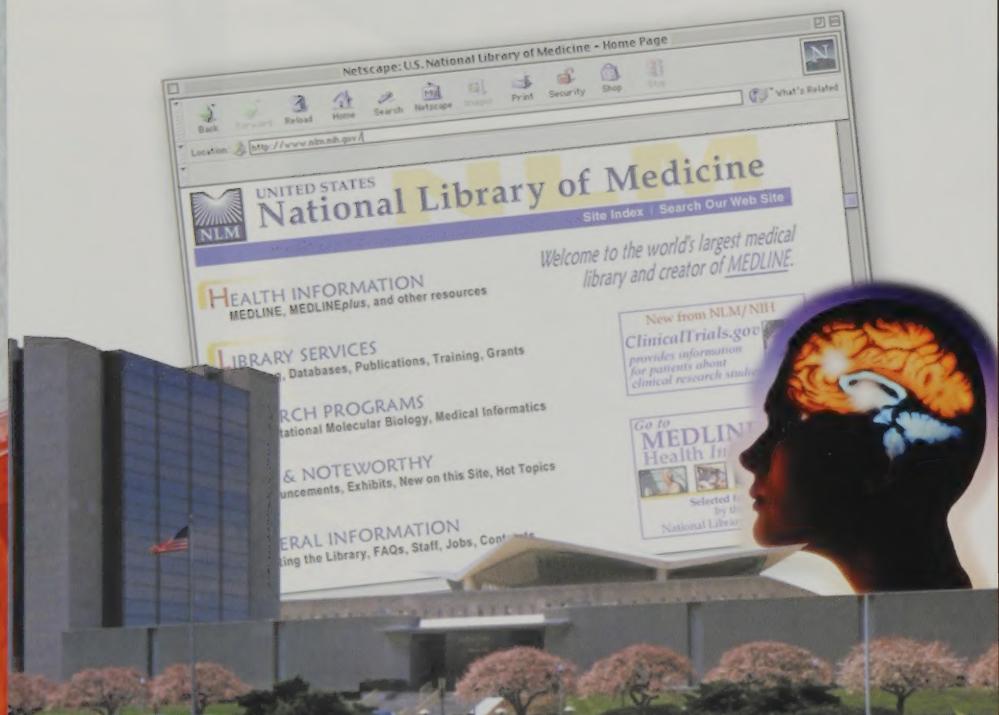


NATIONAL LIBRARY OF MEDICINE

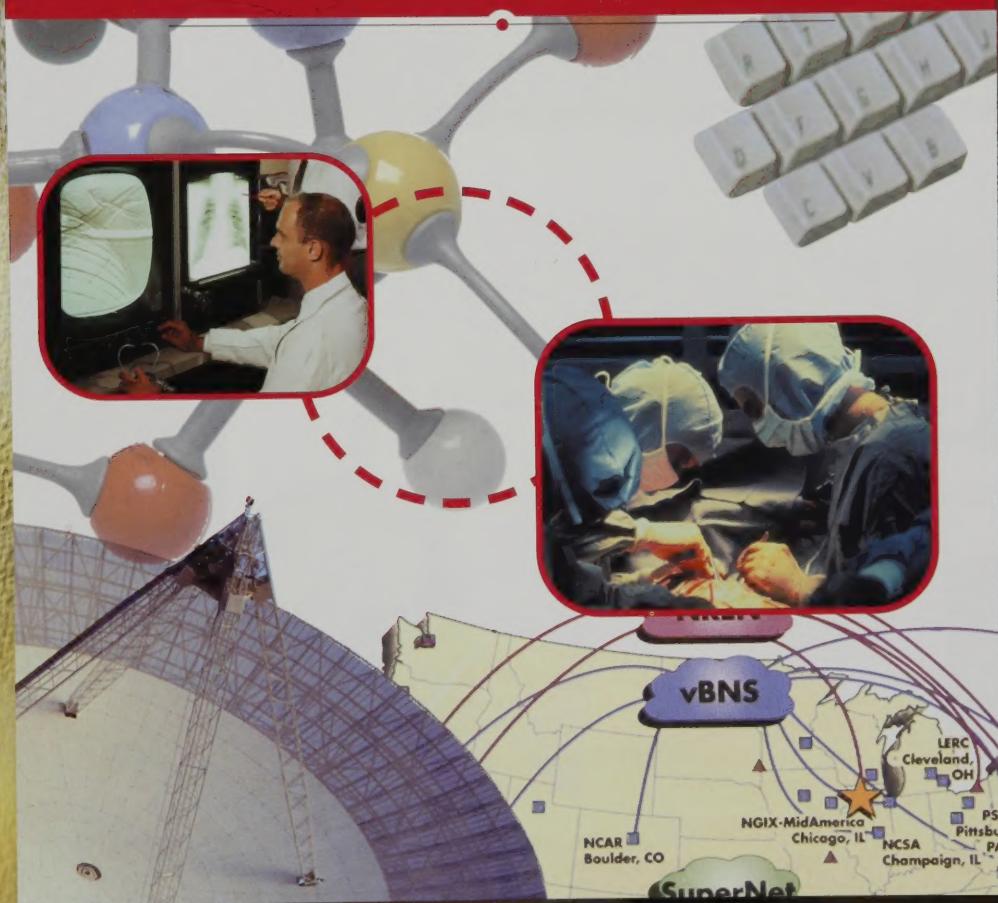
# NLM: The World's Largest Medical Library



**NLM**  
*Black Bag*

NATIONAL LIBRARY OF MEDICINE

## Telemedicine



NLM

*Black Bag*



## A Message from the Director of the National Library of Medicine

Welcome to your library, the National Library of Medicine (NLM). It may well turn out to be one of the most important tools in your medical practice. We not only house millions of journals and books (some going back 1,000 years), but we're the originator of MEDLINE, the world's major medical information database. When you face a puzzling medical problem, you'll find our family of databases at your service. Of course you have access to the literature at medical libraries. However there's a twist: your patient now has access to the same information you do.

I was recently a guest on the National Public Radio show, "Talk of the Nation." The subject of the broadcast was the tremendous growth in the use of medical Web sites. One of the callers during the show was a woman who has an autistic son. She said that her online searches of MEDLINE helped guide her doctors in improving her son's care and that his health has improved as a result of information gleaned from those searches. We frequently hear such stories about patients doing much better—sometimes lives even being saved—because they or their loved ones have searched NLM's databases for the latest reliable medical information.

So enjoy your "tour" of the National Library of Medicine and should you ever be in Bethesda, MD, you are most welcome to visit us here at the library.



**Dr. Donald A. B. Lindberg, director of the National Library of Medicine teaches a new generation about the Library's databases.**



# The National Library of Medicine

## The World of Medicine at Your Fingertips



### Go to: [www.nlm.nih.gov](http://www.nlm.nih.gov)

The practice of medicine changes with each generation of physicians. But while technological advances in health care are the norm, one of the biggest changes your generation of practicing physicians will face is this: Patients will have easy access to much of the medical information that only physicians historically have had access to. The patient will be looking over your shoulder

in ways that were not possible in the past, which brings us to the National Library of Medicine (NLM), the world's largest medical library.

The Library got its start in the early 1800s with just a handful of books. Today, its collection encompasses 6 million items and houses the most complete databases of medical information in the world. We disseminate this information not only directly via the

Internet, but patrons can also obtain medical journal articles through a national network of medical libraries (4,500 of them). This national network also maintains a variety of outreach programs geared toward the health professional community.

In the past, the Library's collections were consulted primarily by physicians and other health professionals. Search fees, limited access to computers and

cumbersome search engines precluded widespread public use. But all that has changed. In 1997, searching NLM's databases was made free, and with the explosive growth of home computers and easier search mechanisms, the general public has embraced searching for medical information with gusto.

As a practicing physician, you will find that more and more people are logging online for their health information. While you might assume that the largest group of Web surfers are those under 30 years of age, according to a

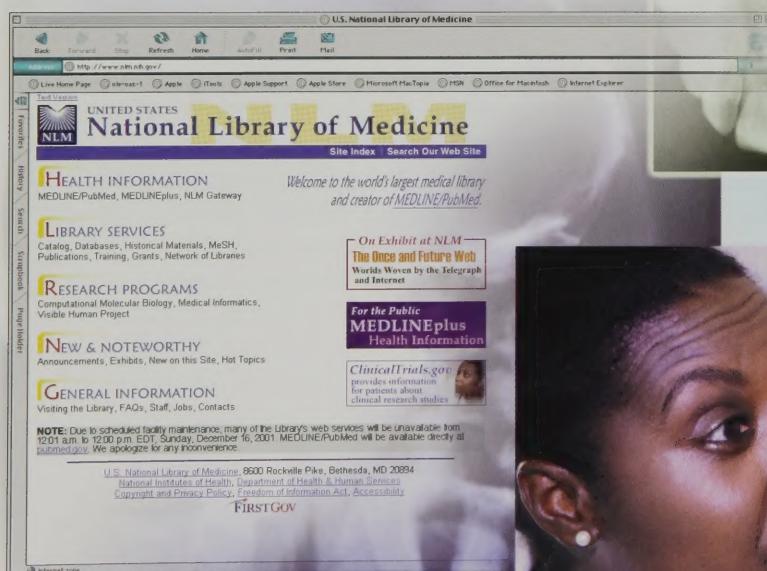
recent report by Media Metrix, it's baby boomers and seniors that make up the fastest growing Internet population. According to the same report, the older age group comprises 20 percent of total online users, outpacing 18-24-year-olds who lag at 17.5 percent. Older Americans have embraced this "new" technology.

The following search statistics give you some indication of how many people search our databases: MEDLINE receives approximately 400 million hits annually; MEDLINEplus, 70 million hits;

and ClinicalTrials.gov receives some 30 million hits.

While MEDLINEplus and ClinicalTrials.gov are aimed to meet the needs of consumers, MEDLINE is the database more geared towards physicians. Its extensive data base of over 4,500 medical journals makes it a must for the practicing physician.

The Library's newest wrinkle in the search engine world is "one-stop shopping" for all of NLM information resources. Known as the NLM Gateway (<http://gateway.nlm.nih.gov>) it



The screenshot shows the homepage of the National Library of Medicine (NLM) website. The header features the NLM logo and the text "UNITED STATES National Library of Medicine". Below the header, there are several sections: "HEALTH INFORMATION" (MEDLINE/PubMed, MEDLINEplus, NLM Gateway), "LIBRARY SERVICES" (Catalog, Databases, Historical Materials, MeSH, Publications, Training, Grants, Network of Libraries), "RESEARCH PROGRAMS" (Computational Molecular Biology, Medical Informatics, Visible Human Project), "NEW & NOTEWORTHY" (Announcements, Exhibits, New on this Site, Hot Topics), and "GENERAL INFORMATION" (Visiting the Library, FAQ, Staff, Jobs, Contacts). A note at the bottom states: "NOTE: Due to scheduled facility maintenance, many of the Library's web services will be unavailable from 12:01 a.m. to 12:00 p.m. EDT, Sunday, December 16, 2001. MEDLINE/PubMed will be available directly at [pubmed.ncbi.nlm.nih.gov](http://pubmed.ncbi.nlm.nih.gov). We apologize for any inconvenience."





searches within and across all NLM databases. Type in the word, "diabetes" and immediately, up pops a screen that tells you what's available on that subject in PubMed, MEDLINEplus, LOCATOR-plus (the Library's "card" catalog of books, manuscripts, and videos), ClinicalTrials.gov, images from the

History of Medicine, plus the other myriad databases that the National Library of Medicine maintains.

"This sophisticated search capability makes it very handy for the physician to get the latest information from diverse sources on a particular disease or disorder," says Donald A.B. Lindberg, M.D.

the Library's director.

While the Library is probably best known for its medical literature databases, it also houses GenBank, the world's most complete collection of public DNA and protein sequences. More than 100,000 species are represented in GenBank including data from

## MEDLINE: The Physician's Silent Research Partner

Go to: [www.pubmed.gov](http://www.pubmed.gov)

It's the physician's own personal bibliographic research tool and with it, he or she can have instant access to all the world's medical journals without having to visit the local medical library. PubMed provides free access to MEDLINE, the Library's premier bibliographic database of 4,500 biomedical journals published in the United States and 70 foreign countries dating back to the mid-1960's.

"If there's a published medical journal out there, no matter how few subscribers or how remote the country in which it is published, you can be pretty sure that it has been considered for inclusion in MEDLINE," said Sheldon Kotzin, the executive editor of MEDLINE.

MEDLINE has even been a key element in a plot in an episode of the prize-winning TV drama, *ER*. During one scene, Nurse Hathaway used MEDLINE to help diagnose a rare disease.

This web-based database covers the fields of medicine, nursing, dentistry, veterinary medicine, the health

care system, and the preclinical sciences. It contains more than 12 million bibliographic citations and abstracts and is continually growing.

MEDLINE also contains links to the full-text versions of articles at participating publishers' Web sites—the LinkOut Service. In addition, MEDLINE provides access and links to the integrated molecular biology databases maintained by the National Center for Biotechnology Information (NCBI). These databases contain DNA and protein sequences, genome mapping data, and 3-D protein structures.

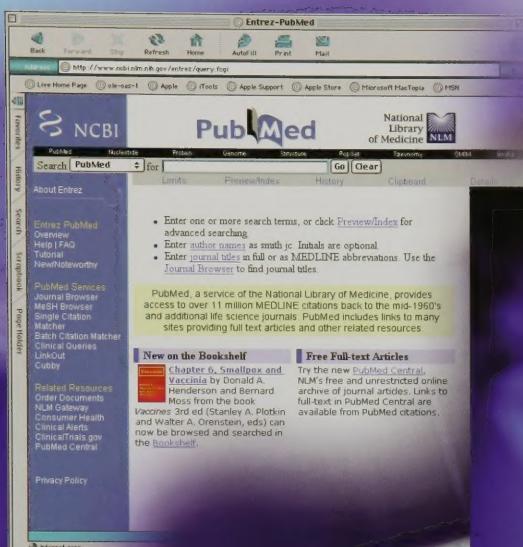
MEDLINE is a powerful yet easy-to-use search tool for finding journal articles of interest in the health and medical sciences. A search screen allows users to search by entering words or phrases. A set of items (title, author, and journal citation data) is retrieved and associated abstracts can be selected for viewing.

A unique feature of MEDLINE is the ability to instantly find articles that are related to any given article. Related articles are pre-computed

based on a word-weighted algorithm. A special clinical query feature facilitates searches for studies based on etiology, diagnosis, prognosis, or treatment of a particular disease. Search results can be viewed in various formats, including formats suitable for downloading into bibliographic reference manager software.

Publishers participating in the LinkOut service may display links to sites providing the full-text of articles. Note that these sites may require users to register or pay a fee before being able to view the full-text. Currently there are over 2,500 online journals accessible through the LinkOut program.

The NLM offers several resources to aid MEDLINE users, including a "Loansome Doc" feature that enables users to request copies of articles from a medical library. The MEDLINE sidebar contains links to a Web-based interactive tutorial, help documentation, and frequently asked questions page.



the Human Genome Project.

"GenBank is an extremely valuable tool for 21st century medicine," said David Lipman, M.D., the director of the National Center for Biotechnology Information, an arm of the National Library of Medicine. "The growth is amazing, doubling every 15 months, and providing an ever richer source for gene discoveries."

We also are home to the "visible humans," NLM's virtual cadavers. A man and woman donated their bodies to science, and their cadavers were frozen, electronically scanned, digitally photographed, and then reformatted into a vast computer file.

Their legacy has been spectacular. To date, the Library has granted over

1,600 licenses to organizations and individuals all over the world to use the Visible Human data sets for all kinds of medical and educational applications.

For example, physicians at the Mayo Clinic used data from the Visible Humans to practice patient-specific prostate and brain surgery before performing real surgery. Research physicians have come up with a new screening method where they can do a virtual colonoscopy for a fraction of the cost, time, and discomfort of a real colonoscopy. These are only two of the many, many medical applications that have resulted from the visible humans.

In the future, some aspects of medicine may even be practiced over the Internet. Next Generation Internet

(NGI) telemedicine projects focus on a wide variety of health projects. For example, a system is being designed in New Haven to help the pathologist make a diagnosis of cytologic specimen from lymph nodes and thyroid. To use the tool, the pathologist creates digitized images of a selected set of cells from a specimen and submits these over the Web. Each image will then be compared to a database and the analysis will produce ranked sets of images from specimens whose diagnosis is known.

The National Library of Medicine will continue to explore the frontiers of medical informatics—it's a promise that both physicians and patients can count on.

# An Interview with Dr. Henry (Hank) W. Foster

## Chairman of NLM's Board of Regents and Health Activist

*Editor's Note: Henry W. Foster, M.D., has led a distinguished medical career. He has been a practicing OBGYN since 1965 and is Professor of Obstetrics and Gynecology at Meharry Medical College. He was former dean at that medical school, and was a senior advisor to President Clinton on teen pregnancy reduction and other youth issues. Not only has Dr. Foster been engaged in clinical practice at Meharry, he has also been the principal investigator in several research projects and the author of numerous journal articles. Dr. Foster is particularly concerned about the problems of teen pregnancy—especially among low-income and minority women. Dr. Foster is the chairman of the National Library of Medicine's Board of Regents.*

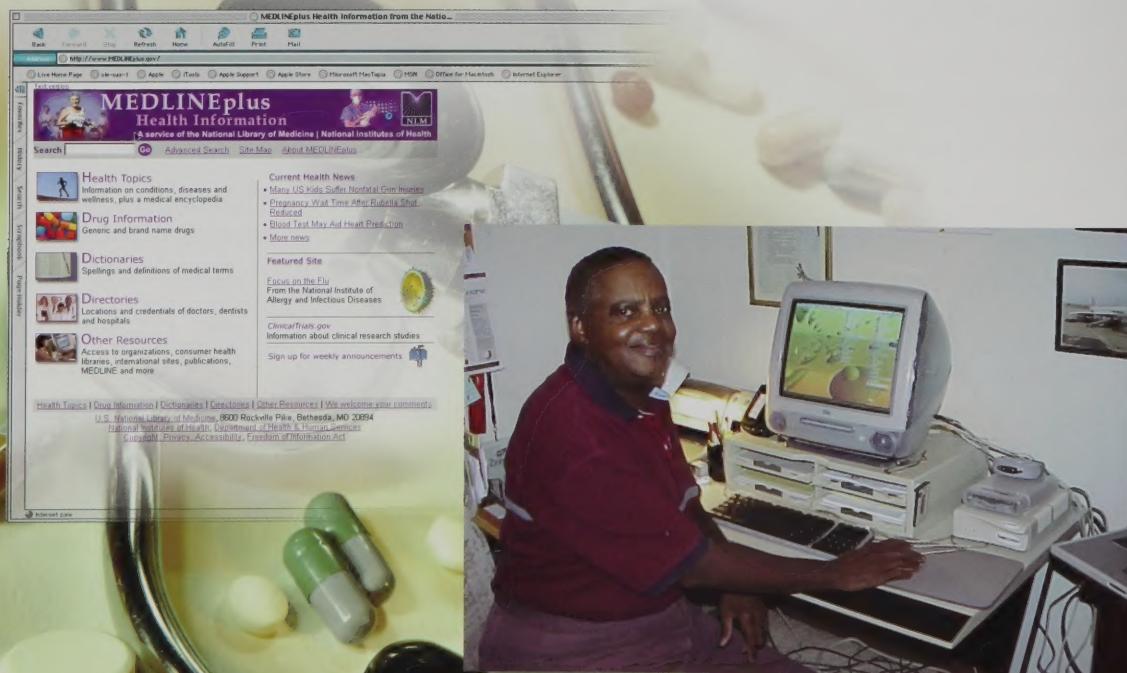
### How has the Internet affected the practice of medicine?

Well, it's certainly made the practice of medicine easier in terms of helping us stay abreast of current medical research which I think has helped make us better physicians. When I first started practicing medicine I can't tell how long it took to search for particular information in medical journals—or how high the stacks of journals could get on one's desk. I also think the specter of litigation has encouraged physicians to keep abreast of the latest in medical research and the Internet has facilitated this updated status.

### How has patients' great access to medical information affected

### medical practice? A positive effect? Negative? Or both?

On balance it's been very beneficial. Let's face it: overall, knowledge is a good thing. One detail I've noticed in my medical practice is that patients use medical databases on the Internet to find out about drug interactions and drug side-effects. When patients visit a doctor they often forget to inform the doctor of all the drugs they may be taking. But in the comfort of their own home they go online to search about possible drug interactions. I've also discovered that patients will do these kind of searches early on in their treatment. That means they can catch potential mishaps before they happen.



**Henry W. Foster, M. D.**



## MEDLINEplus: Just What the Doctor Ordered

### Go to: MEDLINEplus.gov

There are now two ways your patients can obtain the latest medical information. They can visit the local library or they can go online. With MEDLINEplus, the National Library of Medicine's database geared towards consumers, all patients need is Internet access and they can search the medical literature to their heart's content from their own home.

While MEDLINE (see the other boxed article) has been and is the source for medical research literature for physicians, MEDLINEplus lists information especially written for consumers and patients by the National Institutes of Health and other trusted sources.

On MEDLINEplus, for example, your patients can search for information in the online medical encyclopedia or medical dictionary, get information on more than 9,000 prescription and over-the-counter medications provided by the United States Pharmacopeia (USP), obtain information on local physicians and dentists from the online directories, and hook up with consumer health organiza-

tions. The newest addition to the site is daily health story articles from the news services.

MEDLINEplus was launched in 1998 with the general public as the main audience. On MEDLINEplus, NLM's librarians lead patients to the literature by doing searches of MEDLINE on each health topic to retrieve articles that give a review of the latest research and details of clinical studies.

"It saves the consumer a lot of time—and perhaps, frustration that comes from searching the huge MEDLINE data base for information. Basically, we do all the search work for the consumer and just list the key medical articles on a particular disease or disorder," said Eve-Marie LaCroix, who heads up MEDLINEplus.

MEDLINEplus can answer such questions as, How can I tell the warning signs of teen violence? How can I learn about bike safety? Is there a newsletter that tells me about Alzheimer's disease? How do I treat someone who has been poisoned by bleach? What are the current treatment options for brain cancer? How

can I recognize Alzheimer's Disease? What does melanoma look like?

It's a very busy site and has caught on with the general public.

"We currently average over 5 million page hits a month and that number increases all the time," says Lacroix.

A recent survey of nearly 3,000 users showed why this site is so heavily used. The majority of the users were patients or friends or relatives of a patient who were looking for information on a particular disease or medical condition. Seventy-one percent of those surveyed said they were extremely or very likely to return to the site; the vast majority of the users said they found what they were looking for. Eighty percent were very or extremely satisfied with the health information.

Interestingly, many physicians also use MEDLINEplus because it's an easy and efficient way to keep up medical areas outside their expertise. And, of course, many doctors also recommend that their patients use MEDLINEplus, since it's an authoritative site that can best trusted to have credible medical information.

What I think you're going to see is that increasingly the practice of medicine is going to be one of partnership between the doctor and the patient. In a sense, that's not new. Good doctors have always considered their patients as partners. But you will see a greater number of doctors who now practice that way.

### Do you use NLM's databases in your practice?

Absolutely! I use MEDLINE, MEDLINEplus, and ClinicalTrials.gov frequently. I can get timely medical information,

quickly, and the sheer volume of information means that I have access to pretty much everything that's written out there. I also can't emphasize enough how important it is that there's no conflict of interest as pertains to NLM's medical databases. These are the straight, objective facts. There are no hidden agendas.

### How might NLM's databases specifically help in a medical practice?

Let me give you an example. I fre-

quently get questions from women on hormone replacement therapy. As you know, there's a lot of controversy out there: Many women are confused and there's no one right answer for every woman. Despite this confusion, I now find that most women are far better informed about the pros and cons of HRT. And rather than me preaching to a patient, I find that she and I now engage in an informed dialogue.

Another advantage of NLM's databases is that I'm able to find credible med-



ical information outside my specialty. For example, with HRT, we now know that prescribing it to a woman who has had a heart attack is not a good practice. Obviously, heart questions are usually directed to a cardiologist. And while I still encourage physicians to consult with specialists outside their areas of expertise, it sure is convenient to be able to quickly consult the medical literature online.

In fact, quite frankly, I don't know how I practiced medicine before easy Internet access to medical databases!

### **What might you predict for the future of information technology and its impact on patient care and practice?**

We've got a younger population raised on the Internet, and the baby-boomers are also heavy users. We've got increasing numbers of home computers across the nation. And while there is a digital divide—individuals who are too poor to own a computer—their children have learned how to use computers in school and the underprivileged have access to them in school settings, public libraries,

and faith institutions. The numbers add up. Greater numbers of people are going to be using the computer to get information about medicine and health.

My advice to beginning physicians is to become adept at using NLM's medical databases. It's an excellent way to keep up with advances in their particular specialty and to get educated in medical areas outside their field. It's also a great way to stay ahead with your patient, because you can be sure that he or she is using the Internet to get health information!

## **ClinicalTrials: Linking Patients to Medical Research**

### **Go to: ClinicalTrials.gov**

When Margaret McFarland discovered she had thyroid cancer several years ago she turned to a friend who worked at the National Institutes of Health to get the latest information on research studies about cancer. But now McFarland as well as thousands of other patients can search for this information via the Internet on their own.

Clinical trials from all over the world are listed in the National Institutes of Health's most recent database, ClinicalTrials.gov. The spark for this database resulted from congressional legislation in 1997 that mandated a registry for both federally and privately funded trials. The National Library of Medicine developed the database and it was launched in February of 2000. ClinicalTrials.gov has been a huge success: about 5,000 people log on to the site each day and it gets more than 2 million hits per month.

Dr. Alexa McCray, who heads the project, notes that patient groups have become more vocal in demanding

direct access to information on clinical research studies. Many patients are more willing to take an active role in their own treatment. And, says McCray, an informed patient is more likely to be a committed patient. "Increased public access to high quality health information will change the doctor-patient relationship," she predicts.

There are nearly 5,700 clinical trials at 59,000 locations world-wide currently listed on ClinicalTrials.gov with more being added each month. Subjects include everything from sickle-cell anemia to mental health problems, from diabetes to rarer diseases such as Lafora Disease or Fanconi's anemia. While most of the sponsoring organizations are the 21 research institutes of the National Institutes of Health, there are also clinical trials from other Federal agencies, teaching hospitals, and pharmaceutical companies.

The ClinicalTrials.gov web site is easy to navigate. You can search for a clinical trial by disease, location (a name and phone number are included),

treatment, or sponsoring institution. Recruitment status is also shown whether the researcher is recruiting or if the study has been completed.

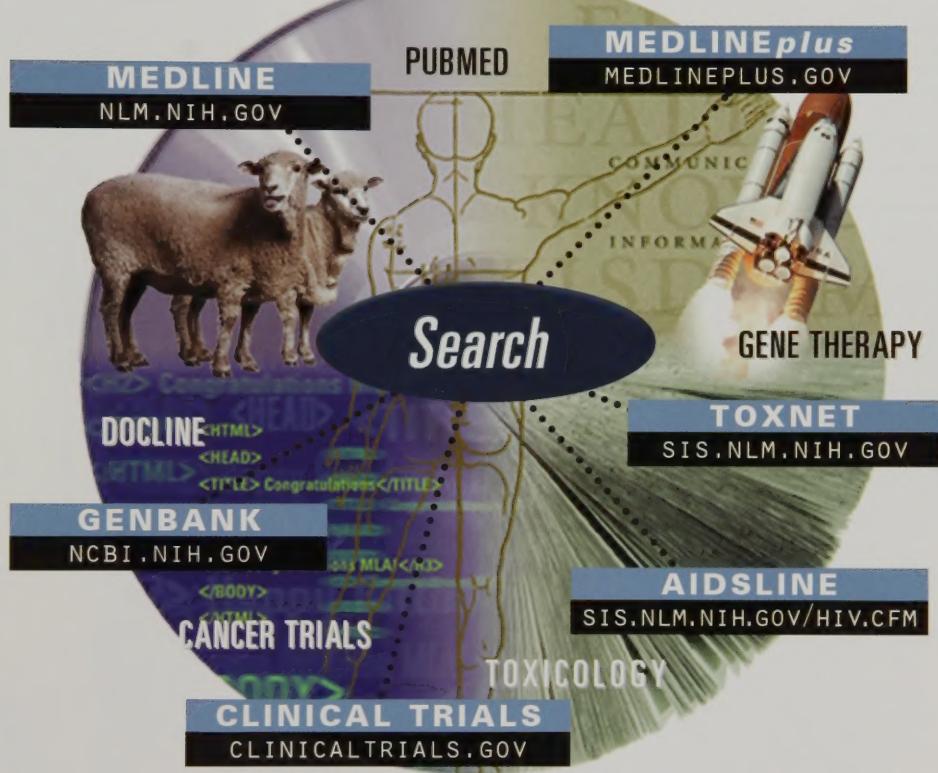
The web site also provides background information on clinical trials and links to MEDLINEplus and MEDLINE. McCray notes that not only do patients find the site helpful, but many practicing physicians also visit on a regular basis to keep up-to-date on current clinical research.

Visitors to the site have made highly favorable comments. One user wrote, "It allows me to see what research is ongoing that may hold some hope for me in the future." Another site visitor wished that ClinicalTrials.gov had been online three years ago and expressed gratitude to those who got it up and running. And yet another said, "it's nice to see a benefit from some of my tax money."

McCray says they are always looking for ways to improve and add new features to help strengthen the site.

# NATIONAL LIBRARY OF MEDICINE

## Our Databases

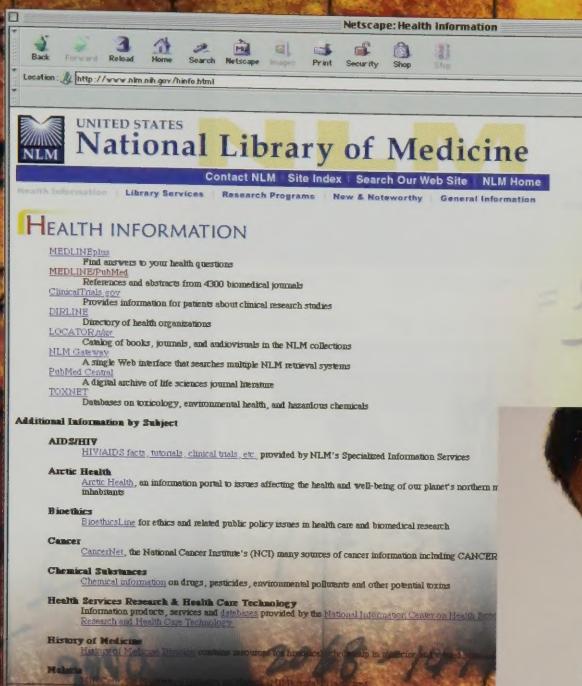


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## Fusion Proteins

## Size of RNA fragments

PCT



# Primer #

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*From the Journal for Minority Medical Students*